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THE LOUISIANA
Soybean & Grain
RESEARCH & PROMOTION BOARD

2020 REPORT

CONTENTS

High-tech hardware may one day assist soybean grading

A biomedical engineer accustomed to studying the composition of human bone is turning his eye toward determining the quality of soybeans.

Kevin Hoffseth, an assistant professor in the LSU AgCenter Department of Biological and Agricultural Engineering, specializes in the analysis of the mechanics and deformation of biological materials.

This past year, Hoffseth was awarded a grant from the Louisiana Soybean and Grain Promotion Board to develop a high-tech grading system for soybeans, and Hoffseth has been working with input from soybean producers and the LSU AgCenter to learn how to improve the current system.

"They say there is an issue with how they do the grading when producers go to sell their crop," he said. "That can be very frustrating. I'm not a producer, but I can empathize with that."

In his discussions with soybean farmers, Hoffseth heard that one truckload of beans could get three different grades from three different inspectors. Hoffseth thinks he can apply image processing and analysis techniques from the engineering world to assist inspectors.

"You import the images into a computer, and you have a set of algorithms that look at each image the same way each time," Hoffseth said. "The thinking is that we hope we can develop some methods and some hardware later on in the next year or two to help the inspectors have some more consistency in the grading."

Hoffseth does not think that computers can replace human inspectors.

"There are reasons for people, and people are great," Hoffseth said. "We are trying to improve the repeatability and cut down on inconsistencies and try to remove different sorts of sampling conditions and try to remove as much gray area as possible."

Soybeans are divided into four numerical grades, No. 1 through No. 4, according to the U.S. Department of Agriculture Federal Grain Inspection Service standards. The soybeans are graded on weight, the percentage of damaged kernels, color and other specifications. A fifth grade, called sample grade, includes soybeans of lower quality.

The amount of foreign material or off-color beans present in the load may also affect the grade. Searching for different shapes and colors to identify foreign material is one place computers and cameras excel, Hoffseth said.

"With cameras and computers, they can do it faster than people," he said. "People still need to oversee the process. Proper computer algorithms can match shapes and identify objects very fast. Let's use that horsepower."

Hoffseth has had little time for full-scale research and development. He and his co-principal investigator, Dorin Boldor, received funding for the grant in April. They faced restrictions into summer because of the COVID-19 pandemic.

While his research has just begun, Hoffseth doesn't foresee robots taking over for humans while grading soybeans.

"Maybe we can design some sort of hardware, camera and lighting that you just put the beans in and it will automatically take an image for quality," Hoffseth said.

Such a system would be designed to cut down on human error.

"It's not left up to a tired inspector out in the sun or in a barn or in a small office somewhere. The cameras don't care. They just evaluate everything the same way every time. We really want to help the people make it better and easier," Hoffseth said. **Kyle Peveto**

Kevin Hoffseth, an assistant professor in the LSU AgCenter Department of Biological and Agricultural Engineering, specializes in the analysis of the mechanics and deformation of biological materials.

According to U.S. Department of Agriculture Federal Grain Inspection Service standards, soybeans are divided into two colors, yellow and other. Soybeans are also divided into four numerical grades, No. 1 through No. 4. Photo courtesy of the USDA.

From the Louisiana Soybean and Grain Research and Promotion Board

This year has proven to be a challenge for Louisiana famers. Yet, the Louisiana Soybean and Grain Research and Promotion Board continues to steward producer-funded dollars toward research that results in the advancement of our commodities. Through the ups and downs of markets, trade negotiations and other economic challenges, the Louisiana soybean and grain farmer continues to lead in his/her field and provide essential food, fuel and other products for people all across the world.

The Louisiana Soybean and Grain Research and Promotion Board (LSGRPB) serves as Louisiana's wheat and corn checkoff and facilitates the national checkoffs for soybeans and grain sorghum in Louisiana. This important responsibility allows farmers to collectively administer funds for research specific to the needs of Louisiana while contributing to the larger national, and even worldwide, market promotion of these staple crops.

By pooling resources at both the regional and national levels, LSGRPB is able to leverage Louisiana farmer dollars to produce Louisiana-specific results. Through efforts with the United Soybean Board (USB), National Corn Growers Association, U.S. Grains Council, United Sorghum Checkoff, the MidSouth Soybean Board and others, Louisiana's soybean, corn, wheat and grain sorghum producers have their production challenges and promotional efforts heard on a global stage. In return, Louisiana's contributions to solutions for our farmers can provide even greater impact for the farmers of our state, right here at home.

With depressed market prices across LSGRPB's scope of commodities, the board has challenged all researchers to submit proposals with an increased emphasis on applied cost savings while maintaining, and hopefully advancing, yield potential. Beyond financial sustainability, the Louisiana Soybean and Grain Research and Promotion Board has also worked this year to advance all areas of sustainability, including work in irrigation, soil fertility, fertilizer and pesticide application, harvest efficiencies and many more.

Through this annual report, we hope you find some area of your farm that is being improved from scientific, credible, data-driven research. Also, the efforts are always being reviewed and refined. So we strongly encourage letting your needs and ideas be heard by attending the next board meeting, which is scheduled on Nov. 19 and 20, 2020, in Baton Rouge at the LSU AgCenter. You can hear reports on funded projects and review new proposals, as well as provide feedback on the needs of your farm and how research and promotion could address them.

On behalf of the board, I thank you for your continued essential service to our industry and to the betterment of the Louisiana and American economies. By continuing the work you do, you are providing vital checkoff dollars to continue important research efforts that will yield a better tomorrow for Louisiana farmers.

Sincerely,

Charles Cannatella
Chairman, Louisiana Soybean and Grain Research and Promotion Board

Soybean and Grain Research and Promotion Board members from left to right back row: *Garrett Marsh, Kim Frey, Dan Turner, Damian Glaser. Front row from left to right: Scott Wiggers, Charles Cannatella, Carlos Polotzola. Not pictured, Darrell Vandeven, J.K. Bordelon, Dustin Morris, Glen Brown, Thomas Ater. Photo by Olivia McClure*

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Looking at the economics of crop insurance and dicamba-resistant soybeans

AgCenter economist Lawson Connor is evaluating the rating methods and returns to crop insurance in Louisiana.

While crop insurance has become one of the primary agricultural risk management instruments provided by the federal government, the cost and potential benefits from the program vary widely across the country.

"Our aim is to understand the methods for determining crop insurance premium rates and evaluate the returns to farmers from using crop insurance," Connor said.

He has been using parish-level soybean yields separated by irrigated versus nonirrigated to simulate yield fluctuations.

"Our results indicate that while crop insurance premiums per acre in Louisiana tend to be higher than premiums per acre in the Midwest, payout frequencies in Louisiana are also higher," he said. This means that while Louisiana farmers pay more in premiums, they also receive more in payments.

"That finding is very context-specific," he said. For example, Louisiana results indicate that crop insurance payments depend both on the parish in question and on the irrigation practices. In some cases, average payments may be higher than in some of the more-productive counties in the Midwest and other parishes where the returns are considerably lower.

"In addition, we find that crop insurance returns are higher on irrigated acres than they are on nonirrigated acres," Connor said.

Conversations with the chief actuarial scientist at the U.S. Department of Agriculture Risk Management Agency suggest the frequency of payment triggers significantly affects the premium rates and the returns to coverage across areas. This point is being further investigated.

Another concern is the county approach to rate setting. Under this practice, the benefit to an individual may be reduced because risks are heavily weighted by average yields at the county or parish level.

"An idea being explored to combat this is a good farmer discount, which may help to solve multiple issues," Connor said.

On the other hand, Connor's results are beginning to shed some light on how crop insurance may be most beneficially used in the state.

"Currently, we find that the benefit, and therefore the optimal insurance plan to choose, may depend on the specific parish and irrigation practice, with benefits being greater on irrigated acres," he said. "Our results also indicate that depending on the parish, 70% coverage on nonirrigated acres may be more beneficial than opting for higher or lower coverage when selecting a yield plan."

Connor is exploring collaboration with Mississippi to augment the mathematical models used to simulate returns on other plans, such as revenue plans. Another avenue is to investigate the value of crop insurance under more realistic assumptions that are used in combination with hedging instruments, such as a futures or options contract, as well as with newly introduced Agriculture Risk Coverage and Price Loss Coverage payment schemes.

"These results may suggest more appropriate coverage and insurance plan selections for farmers in our state," he said.

Along with looking at differences with the Midwest, Connor is examining differences between Louisiana parishes and bordering counties in Arkansas and Mississippi.

"We started looking at broad regions; now we're looking at our neighbors," he said. And based on initial observations, he's seeing some differences.

"We suspect there could be effects of things like soil types and even weather patterns caused by being on different sides of the Mississippi River," he said.

Connor also will revisit previous results with the Midwest and look at farming practices, climate, soils and other differences that could further explain discrepancies.

"Even in Louisiana, some parishes receive better benefits and some parishes receive lower benefits," he said.

Connor has been talking with representatives of the Risk Management Agency and insurance providers to determine if rates could be changed.

"It's a place to start a conversation," he said.

In another area, Connor is working on a project looking at the returns to planting dicamba-resistant soybeans in the absence of significant glyphosate resistance in local weeds.

Some questions have arisen as to whether sufficient yield advantages exist with dicamba-resistant varieties that would support their adoption even where weed resistance is not prevalent. Preliminary results suggest the answer depends on the location and the likelihood of dicamba drift to nontolerant varieties, he said.

"Where farmers have a low prevalence of weed resistance, the benefit to adopting dicamba-resistant varieties increases as the risk for drift increases with the exact threshold depending on the farmer's tolerance for risk," he said.

Research on the issue is continuing with AgCenter yield trials. **Rick Bogren**

New nanodelivery system could help soybean seeds combat fungus

A new type of nanoparticle could aid in protecting soybean seeds from fungal pathogens. Cristina Sabliov, LSU AgCenter researcher and professor in the Department of Biological and Agricultural Engineering, is working on a new nanodelivery system using lignin particles for soybean seed treatment.

Sabliov and her team of researchers have worked with nanoparticles as carriers of agricultural chemicals. This is the first time they have used lignin, a byproduct of the paper industry, to create the particles.

"We are looking at ways to add value to lignin. It's biodegradable, and it's natural," Sabliov said.

Sabliov has used zein, a protein derived from corn, to create particles in the past. She said lignin nanoparticles are more stable in various levels of soil pH.

Given the seedling diseases encountered by Louisiana soybean growers, Sabliov has proposed that fungicides entrapped in nanoparticles can be formulated into a coating able to protect seeds from fungal diseases during storage and the period immediately after seeding.

Nanodelivery of agrichemicals is advantageous over conventional applications, Sabliov said, and using lignin adds more benefits.

"We are checking a lot of boxes. We use a waste product and add value to it," she said. "We developed a delivery system that is very targeted. It's biodegradable. It controls the release of the antifungal, so it's efficient and it doesn't affect the environment."

As the seedling forms, these particles disintegrate in the soil, meaning they have less environmental impact than other products, she said.

Sabliov's team includes biological and agricultural engineer Carlos Astete, entomologist Jeff Davis and plant pathologists Trey Price and Vinson Doyle. They are in the second year of the four-year project and spent the first year engineering the particles.

The researchers took a polymer called poly(lactic-co-glycolic) acid and covalently attached it to lignin. The new polymer was used to make nanoparticles. Sabliov said the lignin stays on the surface; the core is PLGA.

"That core is critical because it is hydrophobic and acts as a reservoir for the fungicide," she said. "You want the formulation to protect that seed from fungus attack during storage and also after planting, but you don't want it to affect the health of the plant."

This year they are testing the impact of nanoparticle seed treatment on soybean health and insect susceptibility, though COVID-19 has delayed some of the research. Sabliov said plant health will be assessed by measuring plant biomass; root and stem lengths; water and nutrient absorption; and chlorophyll concentration. Plants will be tested for changes in insect susceptibility.

"We will challenge the plant with a fungus, and then we will see if our treatment protects the seed," she said.

Sabliov's plan in the next two years is to determine if nanoparticles with entrapped fungicides improve seedling disease control, plant stands, vigor and yield. The treated seed will be sown in hydroponic and sterilized growth media inoculated with *Rhizoctonia solani*, a common soybean pathogen, to assess whether the treatment will protect the plant. Plants will be monitored for differences in disease incidence and severity. **Tobie Blanchard**

In a study, soybean seeds were treated with lignin nanoparticles (LNPs) labeled with fluorescein isothiocyanate (FITC) in order to determine the biodistribution of the particles within nanoparticle-treated seeds before and after one day of germination. Image provided by Eban Hanna

Soil fertility study underway

Rasel Parvej, LSU AgCenter soil fertility specialist, is in the first year of a study on soybean yield response to phosphorus and potassium levels at different soil depths.

"Currently, routine soil tests are based on samples collected from the top 6 inches of soil depth," he said.

His study will compare phosphorus and potassium levels at depths of 0 to 6 inches of soil in addition to 6 to 12 inches and 12 to 18 inches.

He said soybean roots extend beyond 6 inches, and nutrient levels in soils deeper than 6 inches affect soybean growth and development. He said it's possible that deep soil could have adequate nutrient levels available for plant uptake, but the first 6 inches of soil could be deficient, and that often results in false positive errors for fertilizer recommendations. The result could be fertilization that fails to increase crop yield even on soils that test low in nutrient levels based on the upper 6 inches of soil.

Different levels of potassium and phosphorus will be applied in the study. Potassium levels of 0, 40, 80, 120 and 160 pounds per acre will be tested, while phosphorous levels of 0, 30, 60, 90 and 120 pounds will be used.

Parvej is using a high-tech crop sensor to collect data from the plants in the field, and he is taking leaf samples from the plants across the reproductive stages.

Using the sensing system and leaf sampling, he will determine if the crop is under nutritional stress. He hopes the data can help predict yields.

Parvej said soybeans take up the most nutrients during the reproductive stages. He said it's possible that a soybean field could appear to be normal while suffering from nutritional deficiency.

"You wouldn't see any symptoms, and it's called 'hidden hunger,'" he said.

Potassium deficiencies detected with leaf sample analyses can be overcome by applying potassium during the reproductive stage and recover crop yield loss, he said.

Yields responses among plants that receive varying potassium and phosphorus amounts will be compared, he said, and that could lead to calibrating fertilizer rates with soil test results from various soil depths.

The first year of the three-year study is being conducted in 2020 at 18 sites, including five LSU AgCenter research stations (Dean Lee, Macon Ridge, Red River, Northeast and Sweet Potato) and five farms in Avoyelles, Tensas and Franklin parishes. **Bruce Schultz**

Rasel Parvej uses a sensor to help determine plant growth in a soybean field in Avoyelles Parish. Photo by Bruce Schultz

Rasel Parvej collects leaf samples in a soybean field in Avoyelles Parish. The leaves will be analyzed for nutrient content. Photo by Bruce Schultz

Cercospora battle continues on many fronts

LSU AgCenter researchers exploring new approaches for managing Cercospora leaf blight are learning more about what triggers toxin production, when mitigation efforts are most successful, how the fungus is spread in the field and how to speed screening for resistance in soybeans.

Sucrose triggers cercosporin toxin production

AgCenter plant pathologist Zhi-Yuan Chen is studying the correlation between soybean leaf tissue sugar levels and the production of the Cercospora toxin.

"Sucrose production might be the signal that triggers an increase in cercosporin toxin production by the pathogen," Chen said.

Doctoral student Maria Zivanovic, who is working with Chen, has found that soybean leaf sucrose levels increased significantly from the R3 to the R5 developmental stage.

Using leaf extracts in the lab, Zivanovic discovered that the Cercospora pathogen will produce more of the toxin in the R5 extracts than in R3 extracts, and sucrose added to extracts from the R3 stage will produce as much or more of the toxin than in the R5 samples.

"Sucrose had been reported to induce toxin production on other pathogens, but not yet in Cercospora," Chen said.

Zivanovic also found that adding ammonium phosphate to leaf extracts from R5 will suppress toxin production by the pathogen in culture.

Early foliar application of ammonium phosphate when sugar production in the leaves begins to increase may be a solution for managing Cercospora disease, and it has the added benefit of increasing yield, Chen said. However, this is still in the early stage of field trials, and yield estimates will not begin until the project moves to larger field trials.

Chen is also in the third year of a study using a host-induced gene-silencing mechanism-based molecular fungicide to suppress Cercospora leaf blight.

He has isolated more than 10 gene sequences that have shown encouraging results in suppressing the Cercospora and soybean rust pathogens in the studies conducted in the lab.

Rapid lab screening is moving forward

Plant pathologist Sara Thomas-Sharma is continuing to develop a rapid lab protocol for screening for Cercospora leaf blight resistance in different soybean varieties. The results could give breeders a new tool to focus on the number of soybean varieties to include in field trials.

Researchers are measuring the toxicity of cercosporin on smaller leaf discs in the lab to predict disease resistance in the field, where conditions are far more complex. More than 50% of the 25 varieties tested last year in the lab showed consistent disease ratings, Thomas-Sharma said.

Current lab testing will include 25 of the varieties in official variety trials conducted across the state to provide a comparison of each variety tested with disease ratings from field locations.

"Anything we can develop to give some consistency would be a step forward," Thomas-Sharma said. "Something is better than nothing in this scenario because there is no alternative beyond field variety trials."

Iron formulations for managing Cercospora leaf blight

Thomas-Sharma also is looking at iron applications as an alternative to fungicides to help improve soybean resistance to the disease.

"We know that cercosporin toxin can bind to iron, and iron is known to make a plant more resistant to disease by triggering other defense systems within the plant," she said.

Previous work on this project showed that an iron concentration of 300 parts per million in soybean leaves is needed to see any effect against Cercospora leaf blight.

Researchers have recently established baseline data for iron concentrations in soybeans to show how iron content in the plant changes during growth stages. While the lower canopy had higher concentrations of iron, the upper canopy only reached about 100 to 200 parts per million during R3 to R5 growth stages.

"In Louisiana, iron deficiency is not a problem, so what we are trying to do is push iron concentrations over what is normal for the plant to try to improve resistance," Thomas-Sharma said.

Research trials have produced variable results, in part because of changes in commercially available iron formulations. The rate and timing of foliar applications may have also played a role, she said.

Cercospora likely not solely seedborne

AgCenter mycologist Vinson Doyle has identified seven different hosts, in addition to soybeans, for the most prevalent species associated with foliar symptoms of Cercospora leaf blight in Louisiana. It is one piece of evidence that this pathogen may not be solely seedborne.

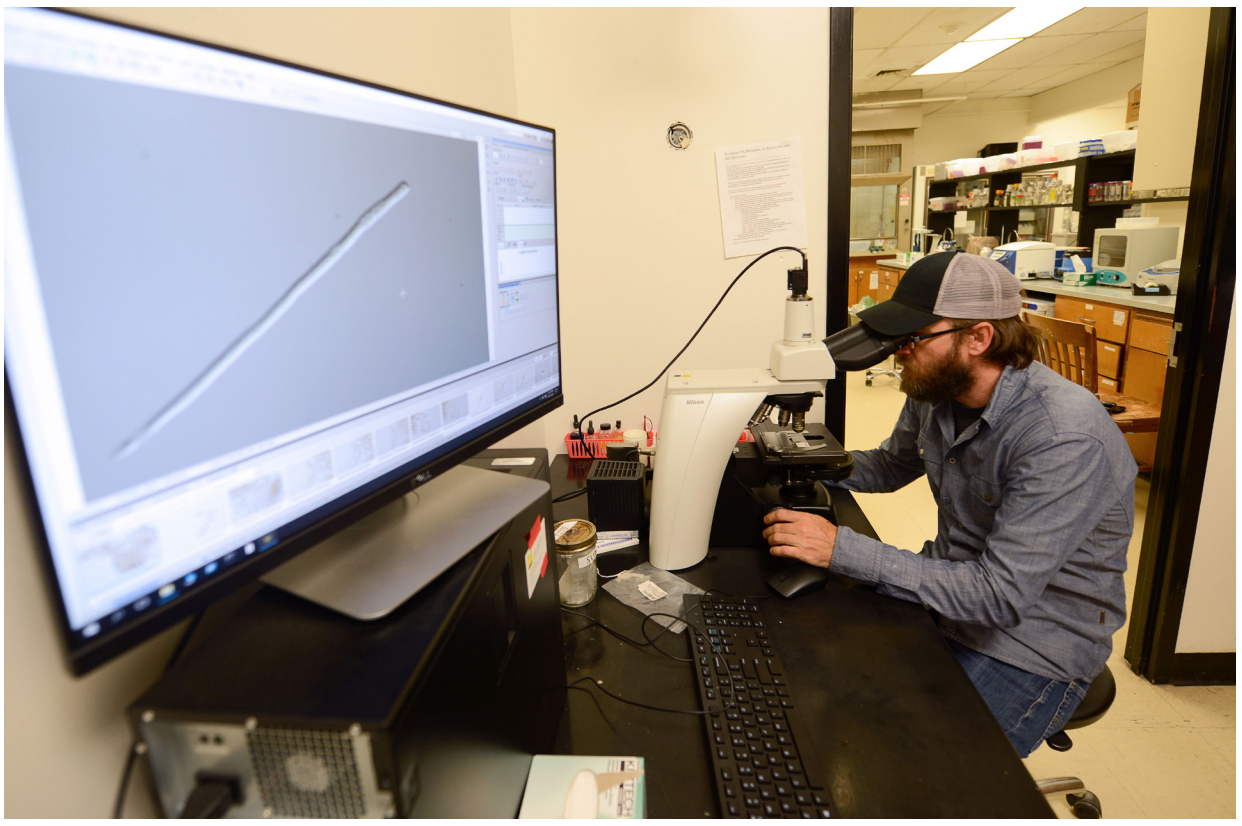
Regardless of the dominant species found on the seed, the pathogen species prevalent on blighted leaves is always *Cercospora flagellaris,* and it shows up on harvested seed, too, he said.

Doyle hopes to confirm that the inoculum for Cercospora leaf blight can be airborne. If it is, he wants to determine when it is moving in the field and how that information can be used to develop better management practices.

Nelomie Galagedara, a doctoral student advised by Doyle and Thomas-Sharma, is monitoring spore traps in the field to collect samples and develop a diagnostic test to rapidly assess the different species on each sample.

"We think if we can identify when the peaks of spore production occur and when the spores are out there at the highest density, then it will be the optimum time to apply fungicides," Doyle said.

Most of the alternative hosts are found in field margins on trees and weed species, such as pokeweed, giant ragweed and even Venus' looking-glass. The study is also trying to determine how long the Cercospora pathogen will survive on plant debris. **Rick Bogren**



LSU AgCenter plant pathologist Vinson Doyle looks at a sample of the Cercospora disease under a microscope. An enlarged image of Cercospora is displayed on the computer monitor. Photo by Olivia McClure

The soil turns red as research associate Clark Robertson sprays a pre-emergent soil application of iron at the AgCenter Macon Ridge Research Station in Winnsboro. Photo by Sara Thomas-Sharma

Precision agriculture is changing the way farmers select crops

On-farm precision agriculture experimentation allows farmers to better select crop varieties and allocate needed resources to targeted zones in their fields, saving money and increasing profit margins.

Luciano Shiratsuchi, LSU AgCenter associate professor and precision agriculture state specialist, is studying the relationship between plant and soil spatial variability and crop varieties in on-farm trials across the state.

"On-farm precision experimentation featuring different soybean varieties and corn hybrids uses soil electrical conductivity sensors to map soil variability as well as drone imagery to capture crop performance," he said.

Sometimes the highest-yielding variety ranked No. 1 is not the most profitable, so variety selection should be site-specific based on parameters beyond traditional yield data, Shiratsuchi said.

Because soil variability has to be measured, a greater understanding of soil variability and varietal performance in a trial conducted by the AgCenter precision agricultural team can assist farmers in evaluating key varieties on-farm, he said.

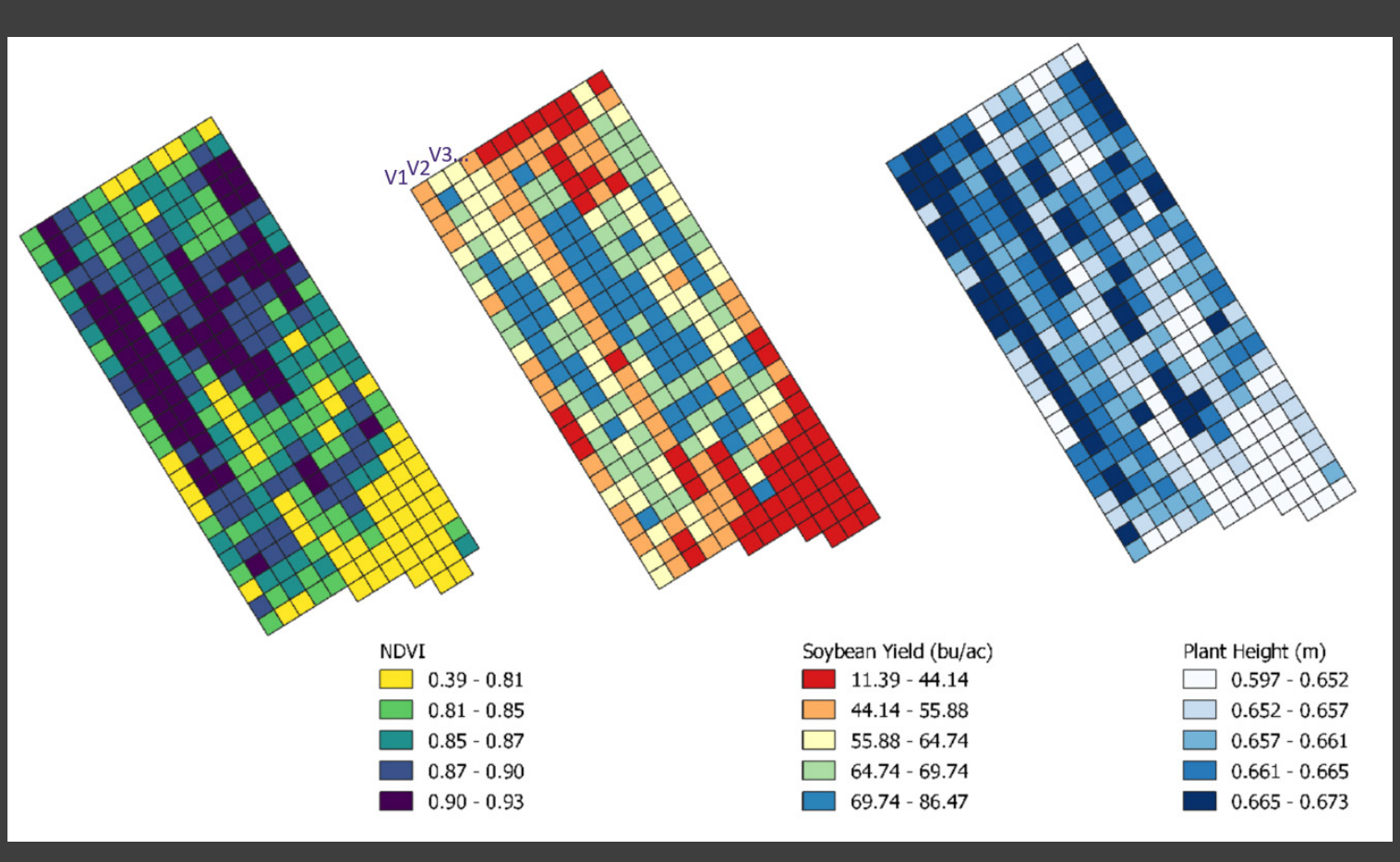
"The best way to extrapolate research results is by participating in an unbiased network of on-farm precision experimentation," Shiratsuchi said.

The approach differs from traditional small plot research because commercial farm machinery with variable-rate controllers is being used in planting, and yield monitors are harvesting long strips without any flag or stake. To learn more about the network, go to www.onfarmprecisionag.com.

The continuation of the project is vital in providing funds for personnel, small sensors and drone maintenance to maintain relevance of this applied research. The COVID-19 pandemic has resulted in little interference with the project's on-farm trials because interference in farming practices was nominal and only small labor inputs were needed to plant strips and plots.

"Many farmers often have some e-technology such as sensors and devices that are by default available on modern farm machinery, but they are not using the data that are being recorded," Shiratsuchi said. Other examples of misuse include owning yield monitors to make yield maps without having the GPS connections to make the maps, data loggers with telemetry not being used to transfer data and in some cases growers paying for an unused cloud account.

Moving forward, Shiratsuchi plans to generate a web database with on-farm precision experimentation beginning with the varieties used by cooperator farmers to generate spatial data and upload new data from future variety trials, commonly referred to as core blocks. **Karol Osborne**



Images submitted by LSU AgCenter associate professor and precision agriculture state specialist Luciano Shiratsuchi

NDVI images show that plant vigor measurements and other characteristics, such as plant height, can be acquired by unmanned aerial vehicles, or drones, and other active sensors available on modern farm machinery can be correlated with soybean yield. Each square width equals one planter pass with a different variety, illustrated by v1, v2, v3. Some soil spatial patterns indicate low yield, NDVI is low and the plant is smaller, illustrating that the data is coherent and that some varieties perform better than others in different zones within the field. While data is still under fine analysis, including the collection of more soil data, the research project promotes the use of farm equipment currently owned by growers but not being utilized effectively.

Scientist looks for ways to improve soybean seed quality

Improving soybean seed quality is the goal of LSU AgCenter research that has been ongoing for the past three years.

In recent years, seed quality has been poor in Louisiana, said AgCenter agronomist and weed scientist Josh Copes. His research is designed to determine the cause.

"It seems that the cause is mainly due to weather conditions," he said. "We've had some heavy rains during several of those harvest seasons."

The damage occurs during the time when the beans are maturing and has been labeled mature soybean seed damage.

"We wanted to evaluate whether there is something we can do production-wise to help minimize the major losses that producers are encountering at the elevator," he said.

In some instances, producers were turned away because their beans were unmarketable.

"In 2018, almost 200,000 acres of the 1.3 million acres of soybean planted were either not harvested or were not marketable," Copes said.

This is stressful for growers because once the crop insurance is paid, that is all they will get for the time and money invested in the crop.

Copes looked at several factors that may be causing the damage, such as date of planting, late-season fungicide application and use of harvest aids.

"What we found is that harvest aids and fungicide had no effect on the quality of the seed," Copes said. "Since environmental conditions are the driver of soybean seed quality, we're looking for something we can do."

Copes said it looks like picking the right variety is a major factor.

"Finding a variety that weathers in the field better than others might be the first line of defense," he said. "Early-maturity Group 5s and late 5s tend to have the best quality."

Although this is the final year for the grant funding his project, Copes will continue to look at seed quality and plans to develop a rating for the different varieties.

The next step in the research is to look at different timings of fungicide applications and continue to rate seed quality in the official soybean variety trials. **Johnny Morgan**

Damaged soybean seed following paraquat and high humidity. Photo by Josh Copes

Insect control research helps crop production

LSU AgCenter entomologist Sebe Brown has several research projects for controlling insect pests on corn, soybeans and grain sorghum.

One project, underway for more than 10 years, is the evaluation of neonicotinoid seed treatments on soybeans against three-cornered alfalfa hopper and wireworms.

Brown said the pests are particularly bad if soybeans are planted after wheat, but the seed treatments are showing a benefit.

"We don't always see an increase in yield, but every year we see better vigor and stand establishment," he said.

Another project involves the use of premix insecticides against stink bugs, particularly the redbanded stink bug.

The neonicotinoid component acts as a repellent and may have the effect of slowing down redbanded stink bug colonization in a soybean crop. "They don't like what they taste, and they fly away," he said

Brown said his work with a viral pesticide Chrysogen continues to show good results against loopers in soybeans.

"It works better some years than others," he said.

The product seems to be more effective in cooler weather with high humidity. The product is inexpensive and is one of the more cost-effective insecticides. It is insect-specific, targeting loopers only, and it doesn't harm beneficial insects, Brown said.

Brown's research is showing the Bt trait still has limited effectiveness against corn earworms in corn. "We don't see an economic benefit to controlling corn earworms in corn," he said.

But borer populations are lower in Louisiana because most growers use Bt corn.

A new project is looking at the use of cultural practices, such as date-of-planting, row spacings and variety selection, in northeast Louisiana to control insects.

For grain sorghum, Brown has a project to determine if sugarcane aphids have become resistant to the insecticides Transform and Sivanto.

"The sugarcane aphid really changed things. It turned a low-input crop into a high-input crop," he said.

The treatments are expensive, Brown said, but they are effective. And so far the aphids have not developed resistance. **Bruce Schultz**

2020 Soybean and Grain Research and Promotion Board-funded projects

Agricultural Economics and Agribusiness.....$78,473

Knowledge Transfer on Water and Soil Policy Reforms to Promote Profitable Irrigation Water Management, *Naveen Adusumilli*

Economic Analysis of Farm Programs and Commodity Costs and Returns for Soybean and Grain Production in Louisiana, *Michael Deliberto*

Evaluation of Optimal Crop Insurance Usage in Louisiana, *Lawson Connor*

Evaluation of Costs and Returns to Dicamba-Resistant Soybean Adoption and Relative Values of Corn/Soybean Seed Treatments, *Lawson Connor*

Evaluating Crop Insurance Rating Options in Louisiana, *Lawson Connor*

Biological and Agricultural Engineering.....$53,000

Fungicide Seed Treatment with Lignin Nanoparticles, *Cristina Sabliov*

Analyzing Soybean Quality with Automated Image Processing, *Kevin Hoffseth*

W. A. Callegari Environmental Center.....$7,500

Drift Mitigation Training Video for Pesticide Applicators, *Kim Brown*

Communications.....$6,000

Louisiana Soybean and Grain Research and Promotion Board Report, *Frankie Gould*

Dean Lee Research Station.....$316,736

Corn On-Farm Demonstration Program, *Dan Fromme*

Utilizing Nuclear Polyhedrosis Virus as a Novel Insecticide in Corn and Soybeans, *Sebe Brown*

Enhancing Field Corn Insect Pest Management Strategies for Louisiana, *Sebe Brown*

Enhancing Grain Sorghum Insect Pest Management Strategies for Louisiana, *Sebe Brown*

Enhancing Soybean Insect Pest Management Strategies for Louisiana, *Sebe Brown*

Evaluation of Phosphorus and Potassium Applications to Commercial Corn Fields in Northeast Louisiana, *Dan Fromme*

Development of UAV Technologies for Soybean and Small Grain Crops, *Randy Price*

Evaluation of Weed Management Practices in Louisiana Soybeans, *Daniel Stephenson*

Investigation of Weed Management Programs in Louisiana Feed Grains, *Daniel Stephenson*

Assessing Soybean Cultivars and Planting Date for Disease Management in Central and Southern Louisiana, *Boyd Padgett*

Disease Resistance and Fungicides for Disease Management in Central and South Louisiana, *Boyd Padgett*

Soybean On-Farm Demonstration Program, *Boyd Padgett*

Entomology.....$96,500

Best Management Practices for Sustainable Insecticide-Resistant Soybean Looper Management, *Jeff Davis*

IPM For Louisiana Soybean Insect Pests, Jeff Davis

Baseline Susceptibility and Resistance Monitoring of Louisiana Corn Earworm Populations to VIP3A, A Novel Insecticidal Protein in Bt Crops, *Fangneng Huang*

Idlewild Research Station.....$40,000

Development of Control Options for Feral Swine in Soybean Fields, *Glen Gentry*

Macon Ridge Research Station.....$161,230

Developing Management Strategies for Corn and Wheat Diseases, *Trey Price*

Developing Management Strategies for Soybean Diseases, *Trey Price*

Managing Foliar Diseases and Head Blights of Grain Sorghum, *Trey Price*

Enhancing Soybean Insect Pest Management Strategies for Northeast Louisiana, *Melissa Cater, Sebe Brown and Tyler Towles*

Reevaluation of Phosphorus and Potassium Fertility at Different Soil Depths for Soybean Production in Louisiana, *Rasel Parvej*

Evaluation of Commercial Foliar Fertilization for Corn and Soybean Production in Louisiana, *Rasel Parvej*

Northeast Research Station.....$192,000

Effect of Crop Inputs on Corn and Soybean Yields in Louisiana, *Josh Copes*

Investigating Cover Crop Impacts on Row Crop Production in North Louisiana, *Josh Copes*

Soybean Seed Quality as Affected by Maturity Group, Row Spacing and Harvest Aid Application, *Josh Copes*

Soybean Weed Control Research in Northeast Louisiana, *Donnie Miller*

Plant Pathology and Crop Physiology.....$215,900

Cercospora Leaf Blight Disease of Soybean — Explore New Approaches for Management, *Zhi-Yuan Chen*

Characterizing the Production and Spread of Inoculum and Infection Strategies for Cercospora Leaf Blight and Purple Seed Stain Pathogens, *Vinson Doyle*

Building the Framework to Develop Integrated Management Strategies for Taproot Decline, *Vinson Doyle*

Development of New Biological Agents for Seed Treatment and Biofertilization to Promote Soybean Growth, *Jong Ham*

Development of New Iron Formulations for Management of Cercospora Leaf Blight of Soybean, *Sara Thomas-Sharma*

Redesigning Fungicide Control Strategies for Cercospora Leaf Blight of Soybean, *Sara Thomas-Sharma*

Screening Grain Crops for Potential Guava Root-Knot Nematode, *Josielle Rezende and Lawrence Datnoff*

The Threat of the Guava Root-knot Nematode (*Meloidogyne Enterolobii*) to Soybeans in Louisiana, *Josielle Rezende and Lawrence Datnoff*

Direct Double-Stranded RNA Application for Managing Cercospora Leaf Blight and Rust, *Zhi-Yuan Chen*

Evaluation of Soybean Germplasm for Novel Sources of Resistance to Frogeye Leaf Spot and Assessment of Pathogen Race Structure in Louisiana, *Jonathan Richards*

Red River Research Station.....$54,150

Soybean Breeding and Variety Development, *Blair Buckley*

Effect of Tillage System on Crop Irrigation and Evaluation of New Methods to Determine Irrigation Initiation Timing, *Syam Dodla*

Evaluation of Micronutrient Fertility to Increase Corn Yields in Louisiana, *Syam Dodla*

Renewable Natural Resources.....$20,000

New Cleaner and Cleaning Method for Soybean Herbicides, *Zhijun Liu*

H. Rouse Caffey Rice Research Station.....$64,900

Evaluation of Soybean Cultural and Fertility Practices in Southwest Louisiana, *Manoch Kongchum and Dustin Harrell*

School of Plant, Environmental and Soil Sciences.....$241,500

Molecular Mapping and Expression Profiling for Development of DNA-Based Markers to Complement Wheat Breeding, *Niranjan Baisakh*

Small Grain Breeding, Variety Development and Testing, *Stephen Harrison*

Sulfur Fertilization Updates: Application Rate, Sources, and Potential of Biostimulant, *Brenda Tubaña*

Improving Micronutrient Fertilization for Soybean Production, *Jim Wang*

Improving Grain Crop Production through Fertilization Integrated Pyroligneous Acid, *Jim Wang*

The Effect of Moisture Content on Harvest Weed Seed Control in Various Cropping Systems in Louisiana, *Lauren Lazaro*

Phenological Shifts in Flowering and Seed Set Due to Selection Pressures of Harvest Weed Seed Control, *Lauren Lazaro*

Impact of Fertilization and Planting Dates on Cover Crop Biomass Production and Nutrient Turnover on Soybean-Corn Rotation Systems, *Brenda Tubaña*

Improving Micronutrient Fertilization for Soybean Production, *Jim Wang*

On-Farm Precision Agriculture Research to Support Variety Trials, *Luciano Shiratsuchi*

Herbicide Resistance Screening in Louisiana Cropping Systems, *Lauren Lazaro*

Southeast Region.....$36,000

Soybean Production Research in Fallow Sugarcane Production Systems, *Al Orgeron*

Total Funding for 2020.....$1,583,889

Cost-effective drones hold potential in identifying crop plant health

Drones have been used for years to help identify the overall plant health of crops, but the cost of that equipment has been a limitation for many farmers. A study funded by the Louisiana Soybean and Grain Research and Promotion Board has been showing comparable effectiveness from less-expensive drones when coupled with proper data processing and data interpretation.

"We've had results slightly better than more-expensive NIR (near-infrared) multispectral cameras and as good as the GreenSeeker," said LSU AgCenter agricultural engineer Randy Price.

Price is experimenting with lower-cost drones readily accessible at big-box stores that capture images in standard RGB — red, green and blue. The images are then processed with software to strip out background pixels of the soil. In the case of rice, water is taken out as well.

"This leaves only the plant spectral properties for evaluation," Price said. "The resulting image can also be evaluated for red absorption, leading to a very accurate assessment of plant chlorophyll production and health, as well as variances in the field."

"The more absorption in the red, the healthier the plant; the more reflective the red, the less healthy the plant," he said.

The expensive NIR cameras capture images that use Normalized Difference Vegetation Index (NDVI) calculations (used since the 1970s with satellites) and scale them to more well-known health indices. The difficulty is that these cameras are harder to use, generate four times as much data and require special processing techniques and high-end computers to operate.

NIR cameras are typically only useable for one purpose — field mapping — and do not allow purposes such as checking fence lines and cattle. In addition, the NDVI indices can be much more susceptible to shadows from the sun and clouds that change and alter the images.

Price has, to this point, conducted his tests on oat, wheat and soybean fields at the Dean Lee Research Station as well as additional tests at offsite corn and rice fields. Post-processing of the RGB images helps remove pixels, and therefore unnecessary noise, that could limit the analysis of the plant itself.

"With all these cameras, we want to see small changes in the field, not just big changes," Price said. "This system we're using produces an image that is similar to a Hollywood greenscreen, except we use a red background, making it easier to see the plants and the plant density in a field without the soil background color."

In order to strip the soil from RGB images, special software (currently unavailable in most software packages) and histograms are required to complete the function. Price is working on methods to take out the soil from the background, using home-written software and special histograms to evaluate fields and the green pixels left in it.

The current problem with standard RGB cameras is some pre-processing may be needed to help the cameras attain sensitivity levels similar to an NIR camera. There is not as much software currently available to help farmers with RGB camera images, while plenty of software is available for multispectral cameras, Price said.

Price has been working to produce a free software toolbox to help farmers process images and interpret the data from these cameras.

"There is a definite learning curve with this technology, and it requires a systems approach that involves multiple steps," Price said. "The real challenge lies in the correct analysis and interpretation of the data."

"We're continuing research on these indices, which are all linearly related to each other," he added. "In the future, farmers may find more incentive to buy these less-expensive drones to evaluate their crops and detect crop variances that indicate plant health and biomass."

Randy LaBauve

Close-up of soybean plants with soil stripping taken with a standard RGB camera drone. Photo by Randy Price

Color threshold on rice plots taken with a standard RGB camera drone. Photo by Randy Price

Mild winter means increase in soybean pests

LSU AgCenter entomologists and graduate students are conducting two research projects to determine ways to improve the economics of soybean farming.

Jeff Davis, AgCenter entomology professor, is looking at insecticides that do a good job of controlling redbanded stink bugs as well as insecticide resistance.

"We are monitoring soybeans to stay on top of what's happening in the fields, and we are prepared to get out there and determine problems so we can advise growers on what they should do," he said.

The current work on pests in soybeans should cause a decrease in the amount of money growers must pay for pest control.

"After the mild weather we had this winter, we are expecting the numbers of redbanded stink bugs to be higher and earlier," he said.

Davis and his student are collecting stink bugs from every parish to determine their tolerance to insecticides.

"We are focusing on three products that are being used to control the stink bugs — neonicotinoids, pyrethroids and organophosphates," he said. "We know that most of these products work well against stink bugs, but some cause increased feeding."

When looking at the economics of the products, the question becomes, "do we kill the insects or protect our soybean yields?" he said.

Weather has been a major factor for growers over the past few years, which allows stink bugs to feed on the beans and cause injury and yield decrease.

"If we could control the weather, that would be the ideal way to control stink bugs. But the next best way is through host-plant resistance," he said. "This means having plants that are able to protect themselves against pests."

The project is in the third and final year, with results coming soon, as Davis' student will soon be graduating.

Davis' second research project is the control of soybean loopers, which is closely connected to stink bug control.

"Sometimes when we find an effective control for stink bugs it causes the loopers to flare, and their feeding increases," Davis said.

What is happening in fields across the South is soybean loopers are now showing resistance to the chemicals that had been effective.

"We have been documenting over the past few years the resistance to insecticides by soybean loopers," Davis said.

He said his colleagues from across the South are sending him soybean loopers, and he is testing them for resistance.

The loopers are not a problem during the early part of the growing season but are known to start showing up in high numbers in July.

Growers need to find better timing schedules for sprays, he said. The problem is when the numbers are at their highest is the same time that the beneficial insects are also in the field.

"So there is the problem of killing pollinators while trying to decrease the redbanded stink bug population," he said.

During the period when the soybeans are in the R2 and R5 stages, the female ratio is much higher than the males.

"Our question is, can we time our sprays to target the females?" Davis said. "The problem is at R2 there are more beneficial insects in the fields."

Davis said at this time of the year the female redbanded stink bugs outnumber the males nearly two to one. However, anything that kills the redbanded stink bugs will also kill a lot of the other insects, he said.

Another approach is to use parasitoids to help in the control of soybean pests.

Johnny Morgan

The tachnid flyis a parasitoid used to help in the control of soybean pests. Photo by Ilgoo Kang

Tradition of core block trials improves crop production

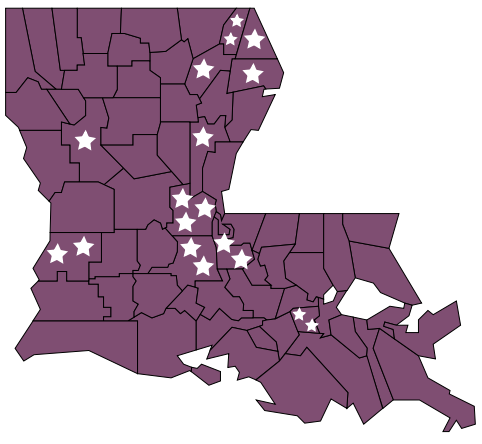
Demonstration plots of new soybean and wheat varieties along with new corn hybrids is a tradition that would make Seaman Knapp proud. Knapp, considered the father of the extension service, was a firm believer in showing farmers the potential of new seeds on the land they farmed.

Dan Fromme, David Moseley and Boyd Padgett are responsible for conducting core block trials across the state. With the help of area extension agents and cooperating farmers, these trials are grown across a wide array of soil types and agronomic practices.

Fromme, the state corn specialist, has 14 locations for his trials. "We typically plant eight hybrids at our sites," Fromme said. "We then compare the yields of these hybrids to the grower's standard hybrid to see the differences."

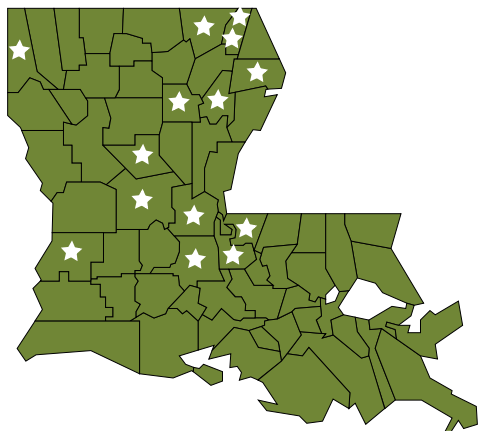
Yield is a common variable all of the trials use, but there are some other factors that are measured.

Moseley, the state soybean specialist, has 18 variety trials statewide. Again, yield is most important, but he has an interest in other traits, such as plant height and lodging, to further evaluate the adaptability of each variety across different environments.



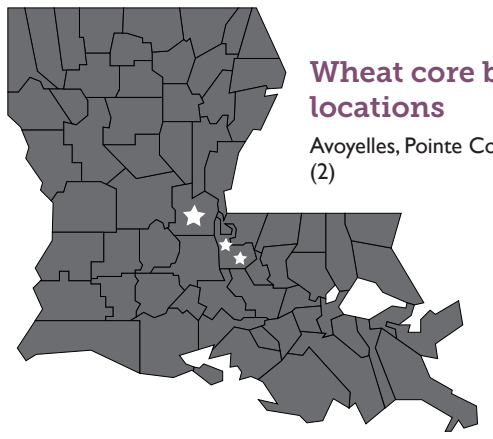
Soybean core block locations

Avoyelles (3), Beauregard (2), Catahoula, E. Carroll, Madison, Natchitoches, Pointe Coupee (2), Richland, St. James (2), St. Landry (2), W. Carroll (2)



Corn core block locations

Avoyelles, Beauregard, Caddo, Caldwell, Franklin, Grant, Madison, Morehouse, Pointe Coupee, Rapides, St. Landry, W. Carroll (2), W. Feliciana



Wheat core block locations

Avoyelles, Pointe Coupee (2)

Padgett, the interim state wheat specialist, has three locations for his research trials.

"Interest in growing wheat has really waned during the past five years," Padgett said. "Disease issues related to scab have discouraged growers from planting wheat, so we have been limited to our locations to conduct these trials."

Because of scab, much of Padgett's work is looking at the prevalence of the disease in plots located on research stations. Fungicides are being studied for their effectiveness by pathologists, which include Padgett and Trey Price at the Macon Ridge Research Station in Winnsboro.

Variety trials have been a tradition of extension research for more than a century. And as long as seed companies continue to develop new varieties and hybrids, the AgCenter will continue to conduct them at farms across Louisiana. **Craig Gautreaux**

Studies analyze long-term benefits of cover crops at planting, termination

Producers in Louisiana have used cover crops for years to help protect their soil, and now two LSU AgCenter researchers are studying the practice to precisely understand the benefits of the practice.

AgCenter soil scientist Brenda Tubaña is studying the cultural management practices of cover crops, focusing on the planting date and fertilization. Agronomist and weed scientist Josh Copes is researching cover crop effects on row crop production with a concentration on cover crop termination dates.

Anecdotal information on cover crops is plentiful, Tubaña said, but the scientists want to put hard numbers on their long-term contributions to the main crops.

"What we are doing now is understanding what is really happening," Tubaña said. "What are the specific benefits, and what are the compounding effects that would lead to improved soil health and quality and then improved crop productivity?"

Tubaña is studying nutrient recovery in cover crops. Cover crops pick up nutrients from the soil during the fallow periods and incorporate them into their biomass. When producers terminate the cover crops, the biomass can decompose and release nutrients back into the soil.

"What if we try to improve biomass accumulation of cover crops to begin with because that will become the main source of nutrients," Tubaña said. "It's like a storage of nutrients that would have otherwise been left in the field and lost via runoff or leaching."

In her research, Tubaña plants a combination of legumes and plants from the brassica family, hairy vetch, tillage radish and crimson clover. The studies compare fertilized and nonfertilized plots planted in September, October and November. Soybeans and corn planted in rotation are the commercial crops in the study.

"What we want at the end of the day is to improve the biomass that contains all the nutrients so that when we burn them down in spring prior to planting annual crops, the composition of biomass will result in the release of nutrients that will be used by the main crops," Tubaña said.

The earlier-planted cover crops accumulate more biomass, Tubaña said, and soil tests show this leads to an increase in nutrients.

While Tubaña is focused on the planting date and establishment of cover crops, Copes is studying the effect of termination timing on the main crop. The study includes a rotation of corn and soybeans, a rotation of soybeans and cotton, and a rotation of cotton and corn.

"We look at terminating the crop either six weeks prior to anticipated planting, or four weeks, or two weeks, or at planting," Copes said. "The at-planting treatment either got a nematicide or it did not. I'm trying to see how the nematode population could be affected by allowing the cover crop to grow longer."

So far, Copes has not seen a positive or negative effect on nematode populations.

Also, Copes has found that termination timing of cover crops matters, but a late termination is not a calamity for a crop.

"You have to try to get it done in a timely manner — four to six weeks out," he said. "But if you couldn't for some reason, don't freak out. It's not really hurting us as bad as we once thought because we're all running seed treatments on our seeds."

Another study focuses on cover crop species and includes two cereals — cereal rye and black oats — a legume, hairy vetch and combinations of these. They are all terminated six weeks before the target crop is planted.

Cover crops suppress winter weeds, and the evidence is seen in the fields, Copes said. In his research, Copes wants to see how cover crops affect the main crop, and that answer will likely take years of research.

"Really, with cover crops, I have not seen any negative impacts from growing them," Copes said.

Short-term findings show that the main crop's yield doesn't benefit a great deal from cover crops.

"They aren't getting a bump from the cover crop, but they are doing a lot of other things: protecting from the soil erosion, building soil health," Copes said. "The main thing is, in my opinion, we've got to keep the soil on our fields instead of losing it."

The choice of a cover crop depends on the producer's needs. The "jury is still out whether there is a better cover crop for each crop," he said.

Like Tubaña, Copes is also planning to analyze the effects of cover crops on soil for long-term studies.

"It's hard to measure changes in a few years," he said. "It takes a little time."

Tubaña agrees that the benefits of cover crops will likely be found in long-term studies.

"It is not going to be seen on a short-term adoption of this practice," Tubaña said. "It will take a while. Cover crops have a compounding effect, bringing in benefits. That does not happen overnight." **Kyle Peveto**

Two months of growth can have a large effect on the biomass produced by cover crops. The plot on the left, photographed at the AgCenter Central Research Station in February 2020, was planted in November, and the plot on the right, which was photographed the same month, was planted in September planting date. Photo by Daniel Forestieri

Research on pests aims to improve soybean yields

LSU AgCenter sugarcane pest specialist Al Orgeron has two projects underway that could help soybean yields.

He is working with AgCenter agent Jimmy Flanagan to test several crop additives to determine their effectiveness. The companies selling the products claim they help soybeans in stressful growing environments.

The products are Harvest Plus, Allevia, Fullscale, Bio-Forge and ANOVA.

"Most of them are untested in Louisiana," Orgeron said.

The products were first applied with a ground rig at the R2 and R3 stages. A second foliar application followed 21 days later. The plots, located at a farm in Franklin Parish, are 35 feet wide by 250 feet long.

Imagery made with a drone hasn't shown any differences, but the yield results will provide the best indications of any effectiveness, Orgeron said.

Most sugarcane growers were reluctant to plant soybeans in 2020 because of the price.

"There's not a whole lot of room for profit with $8.50 beans," Orgeron said.

Orgeron also is working with AgCenter agent Matt Foster to investigate the value of adding insecticide to paraquat desiccant spray. Redbanded stink bugs can be found in large numbers in southeast Louisiana bean fields, and they can inflict heavy damage.

"There's not a whole lot of research about adding insecticides to desiccants," he said.

These tests will be conducted on commercial farms in Franklin and in Vacherie on plots 35 feet wide by 1,000 feet long. The treatments will include paraquat plus acephate, paraquat plus Lannate, and paraquat only.

AgCenter agronomist Manoch Kongchum is conducting date-of-planting and fertility studies at the South Farm of the H. Rouse Caffey Rice Research Station in Crowley and at a farm near Iowa, Louisiana.

To replicate growing conditions in southwest Louisiana, no raised beds or irrigation are being used.

The date-of-planting study has planting dates of March 25, April 14, May 5, May 21, June 1 and June 10 with maturity groups ranging from 3.0 to 5.4.

Kongchum has been conducting the study since 2017.

"The optimum date of planting is about mid-April until the end of May," he said.

The fertilizer trials with potassium, phosphorus, sulphur and zinc did not show much difference in the rates or timing trials, but that may have been because of heavy rain after planting and poor stand establishment almost every year of the work, he said.

Kongchum also has a date-of-planting study this year at the Dean Lee Research and Extension Center with AgCenter soybean specialist David Moseley. **Bruce Shutlz**

Manoch Kongchum inspects a soybean plot for his date-of-planting study at the South Farm of the H. Rouse Caffey Rice Research Station near Crowley. Photo by Bruce Schultz

New cropping systems, methods part of weed control research

Weeds will decrease crop yield if they are not properly managed, but successfully tackling weeds means keeping pace with their developing resistance to herbicides.

LSU AgCenter researchers have been conducting field tests in different regions to evaluate weed treatment programs for new cropping systems in unique soil and climatic conditions.

Tests conducted in 2019 at the Northeast Research Station in St. Joseph showed good results for transgenic Xtend and Enlist cropping systems, as well as the HPPD system, which stands for 4-hydroxyphenylpyruvate dioxygenase.

"The Balance Bean herbicide utilized in the HPPD soybean weed control system gave good to excellent control of most broadleaf and grass species and should be a safe, useful tool in a complete weed management system," said AgCenter weed scientist Donnie Miller.

Post-emergence applications of glyphosate in combination with dicamba in Xtend or 2,4-D choline in Enlist soybean weed control systems, double-cropped, following wheat, provided excellent control of most grass and broadleaf weeds common to the region, Miller said.

Miller still recommends including residual herbicides with both weed management systems to prevent weed seeds from germinating and competing early season and to aid in resistance management.

"The ultimate goal is to stay weed free to allow the soybean plants to provide natural residual control in the form of shade later in the season," he said.

"We found that the addition of commonly used insecticides did not cause crop injury when co-applied with glyphosate plus Xtendimax or 2,4-D choline," Miller said. "This offers producers the opportunity to reduce production costs associated with separate applications."

At Dean Lee Research Station in Alexandria, research has been focusing on programs in Xtend, Enlist and GT27 technologies in soybeans.

"Some of the most difficult weeds now are Palmer amaranth and waterhemp," said AgCenter weed scientist Daniel Stephenson. "Although it has been problematic in the past, prickly sida, or teaweed, has become more prevalent, leading to more control issues."

Stephenson said regardless of row spacing and time planted, a two-pass herbicide program is needed in soybeans.

"Growers should spray a residual herbicide pre-emergent. When it starts to fade after three to four weeks, tank-mix a residual herbicide with your nonselective like glyphosate, glufosinate or others," he said.

A new technology in the battle to stop weeds is harvest weed seed control (HWSC). AgCenter agronomist and weed scientist Lauren Lazaro has been testing two of the six types of HWSC at the Central Research Station in Baton Rouge.

"We have done two years of narrow windrow burning and one year of chaff lining," Lazaro said.

Narrow windrow burning funnels the chaff and straw from the combine into a windrow where it's burned, while chaff lining sends only the chaff fraction into the windrow, allowing natural elements to break down the seeds through decay and predation.

"General observations show that both options reduce the amount of seeds that enter back into the soil seedbank," she said.

"We are always trying to layer alternate modes of action and expose weeds to as many modes of resistance as possible," Miller said.

"We're trying to put together programs for our farmers, but it's not a one size fits all," Stephenson said. "Every year, it's just another change; there's never an identical year." **Randy LaBauve**

Weed management with glyphosate plus Xtendimax following residual herbicides at planting in Xtend soybeans, Dean Lee Research Station, Alexandria, Louisiana. Photo by Marcie Mathews

AgCenter research keeps pace with onslaught of disease in soybeans, other grains

Diseases continually threaten yield and profitability of soybean, corn, wheat and sorghum crops in Louisiana. That's why research to minimize damage has continued to be an important part of LSU AgCenter research efforts conducted at multiple research stations and on farms.

The LSU AgCenter is working on various approaches to improve soybean resistance to many diseases.

Trials consisting of 30-45 entries — mainly advanced breeding lines and commercial varieties — have been conducted since 2016 across Louisiana and the Midsouth, and scored for Cercospora leaf blight. This research, done under the leadership of top breeders, including AgCenter soybean breeder Blair Buckley and other universities, has identified some commercial varieties and soybean germplasm that showed resistance to Cercospora leaf blight.

"Breeders have already begun utilizing the material to incorporate into elite lines for variety development," said AgCenter plant pathologist Trey Price.

Official soybean variety trials at multiple research stations are rated each year for naturally occurring diseases and can be used as a tool for producers when making planting decisions. Results can be found on the Louisiana Soybean Varieties page LSU AgCenter website (https://bit.ly/3kdCu0D).

Taproot decline has been an emerging disease problem, and researchers at the Macon Ridge Research Station and in other Midsouth states have looked at many fungicide seed treatments and in-furrow sprays as potential management options.

"We're seeing some promise with a few specific fungicide modes of action and are moving forward looking for consistent efficacy over multiple years and locations," Price said. "We aim to determine which products producers can use at planting and at which rates they are most effective against the taproot decline pathogen."

In addition to at-planting fungicide trials, 2019 marked the third year of taproot decline rotation and tillage studies. AgCenter results showed that rotation to corn, cotton or grain sorghum and conventional or minimum tillage lower disease incidence and severity in soybean.

Louisiana's hot, humid conditions also help create the perfect environment for foliar diseases. Many foliar fungicide efficacy trials in 2019 identified products effective on Cercospora leaf blight, frogeye leaf spot and aerial blight.

"We're seeing activity with a number of SDHI compounds along with newer generation DMIs on Cercospora leaf blight and aerial blight," Price said. "This has been a welcome development, as products containing QoI materials have been ineffective for a number of years due to fungicide resistance in multiple pathogen populations."

In the event of a disease outbreak, fungicide applications, if warranted, may preserve yield and quality, he said. "We can manage most foliar soybean diseases reactively, which means we don't have to treat every acre with prophylactic applications. With judicious use of the effective products, we can prolong their usefulness and delay fungicide resistance development."

Future soybean studies will continue to identify and develop resistant soybean varieties, as well as keep up with a constantly evolving fungicide industry. There are also knowledge gaps concerning lesser-known diseases in Louisiana like Southern root-knot nematode, reniform nematode, target spot, Septoria brown spot, Southern blight, charcoal rot, sudden death syndrome and red crown rot, Price said.

Official wheat variety trials were rated for resistance to leaf rust, scab and stripe rust.

"The big one is wheat scab, and we're looking for varieties with resistance to scab as well as the best fungicides for applications at flowering," Price said.

AgCenter researchers conducted many foliar fungicide trials in corn, where Northern corn leaf blight and Southern rust developed to moderate levels.

There are many fungicide options, and the most effective ones were identified. These results may help growers find less-expensive treatments that are just as effective.

"Some farmers have been in the habit of applying fungicides regularly, even when there's no disease," Price said. "The key is to determine whether you need to apply or not because our data shows no yield bumps or other benefits when spraying nondiseased corn."

Besides doing research, Price and other pathologists help growers identify what's in their fields and on their plants.

"I constantly get photos, lab samples and field calls from growers, consultants and industry asking about problems on their plants, and probably 30% to 40% of the time it's not disease at all," he said.

Grain sorghum official hybrid trials for 2019 indicated varying susceptibility to multiple diseases. Results at one site indicated a good set of anthracnose ratings, Price said.

Fungicides are not effective on head blights; therefore, identifying hybrids that are resistant to head blights is important, he said.

Researchers completed four foliar fungicide trials for sorghum and found they were effective on a disease complex consisting of anthracnose, target spot and zonate leaf spot. Overall, foliar fungicide treatments in cases of moderate to severe disease lowered the disease severity and preserved yields.

"The two biggest diseases for sorghum are anthracnose and target spot," Price said. "Typically, foliar fungicides that work for anthracnose might not work for target spot. That's why disease identification is key."

In-furrow and seed treatment fungicides were not effective on stand or yield of sorghum.

"Sometimes negative data is useful," Price said. "In this case, it shows growers what not to do."

The success of maintaining control of diseases in soybeans, wheat, corn and sorghum depends upon continuing research that keeps pace with the constant onslaught of existing and emerging diseases and an evolving industry.

"Our research trials are designed to generate practical information that farmers can use to stay in business," Price said. "That's the mission of the AgCenter and that's what farmers pay us to do."

The AgCenter has developed and maintains a disease management guide for all plants grown in Louisiana in the Louisiana Plant Disease Management Guide (https://bit.ly/2XrKXn8). **Randy LaBauve**

Corn that was fungicide-treated in field tests by the AgCenter. Photo by Trey Price

Nonfungicide treated corn with Northern corn leaf blight in field tests by the AgCenter. Photo by Trey Price

Retirements and new hires

Rogers Leonard

After decades of service with the LSU AgCenter, Rogers Leonard retired in March 2020. Leonard earned his bachelor's, master's and doctoral degrees from LSU. He spent much of his career as an entomologist in northeast Louisiana, where he researched insect pest management strategies in row crops. He later became an associate vice president and program leader of the AgCenter, a role in which he oversaw research and extension efforts related to plants, animals, and soil and water resources across the state. In his time with the AgCenter, Leonard authored or co-authored nearly 1,100 scientific, technical and outreach articles. He mentored 66 graduate students and served on a number of national committees and panels for government entities and industry groups.

David Moseley

David Moseley is the statewide soybean specialist. He previously was a production research scientist with Monsanto and an extension agent with the University of Arkansas. His doctorate is from the University of Arkansas in crop, soil and environmental sciences; he focused on soybean breeding and genetics. As the AgCenter soybean specialist, Moseley's job responsibilities largely center on extension outreach work. However, he also is planning to conduct studies on soybean varieties' adaptability to different soil types and environments across Louisiana as well as optimum planting dates, plant populations and row spacing.

Rasel Parvej

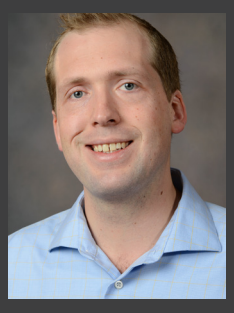
Rasel Parvej, a soil fertility and agronomy specialist, joined the AgCenter after serving as an assistant professor at Bangladesh Agricultural University, a research assistant while completing his doctorate at the University of Arkansas and a postdoctoral researcher at Virginia Tech and Iowa State University. Parvej is based at the AgCenter Scott Research and Extension Center in Winnsboro. He is working on developing fertilizer recommendations and improving nutrient management based on a variety of factors, including site-specific soil fertility, nutrient stratification and uptake dynamics, and soil and tissue testing.

Tyler Towles

Tyler Towles is an entomologist at the Scott Center in Winnsboro. He earned a doctorate at Mississippi State University and has previously worked for Dow Agrosciences. His dissertation focused on the implementation of seed-blended refuge in mid-Southern corn production systems compared to structured refuge systems for the production of Bt-susceptible corn earworms. His research at the AgCenter will include a wide range of pest issues in corn, cotton, soybeans and grain sorghum. Some of his current projects are corn earworm Bt resistance selection in corn and stink bug control methods in soybeans.

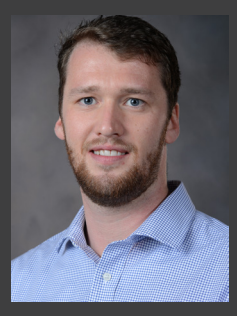
Jonathan Richards

Plant pathologist Jonathan Richards holds a doctorate from North Dakota State University and conducted postdoctoral research with the U.S. Department of Agriculture Agricultural Research Service in Fargo, North Dakota. Richards' research interests include the dissection of host genetic resistance to fungal pathogens using molecular biology and genomics approaches as well understanding pathogen infection strategies. Based in Baton Rouge, he also teaches a microbial genomics course for graduate students.



Tristan Watson

Tristan Watson is an assistant professor of nematology and the director of the AgCenter Nematode Advisory Service. He received a doctorate from the University of British Columbia and completed postdoctoral training at the University of Florida. He previously researched integrated nematode management on tree fruits, small fruits, vegetables and alternative crops such as hops, hemp and artichokes. At the AgCenter, his plans include establishing a research program targeting nematode problems in soybeans and grains and evaluating new nematicide formulations and other management approaches. He also is surveying the distribution of the guava root-knot nematode in Louisiana soybean and grain production as well as screening soybean varieties for host status to this new invasive pest.



Guava root-knot nematode continues under scrutiny

In 2018, the guava root-knot nematode was discovered on a farm in northern Louisiana. It was the first — and so far, the only — sighting of the destructive pest in the state.

Though the pest has yet to spread through Louisiana as it has in other states, LSU AgCenter scientists are nevertheless trying to learn as much as possible about it so they can help farmers if more infections occur down the road.

A nematode is a microscopic worm that feeds on and damages plant roots. The guava root-knot species is particularly devastating; it can cause wilting and root galling severe enough to result in total yield losses in several crops.

Much is unknown about this pest, which is a relatively new arrival to the U.S. Originally from Asia, it was found in Florida in 2001. Ten years later, it showed up in North Carolina, where it has devastated sweet potato fields.

With the help of some high-tech tools, scientists with the AgCenter Nematode Advisory Service are studying differences between the guava root-knot nematode and the more common Southern root-knot nematode. The two are similar but can be distinguished when examined at the molecular level.

AgCenter plant pathologist Josielle Rezende is using a technique called loop-mediated isothermal amplification, or LAMP, to identify the nematodes. DNA is extracted from nematode-infected plant roots, then incubated with species-specific primers and reagents.

"If the target nematode is present, the DNA will be amplified," Rezende said, allowing it to be detected on an instrument that monitors fluorescence.

"LAMP is a fast, sensitive and economical molecular technique that can be used for increasing the efficiency of diagnosis and management," she said. "The LAMP assay can be performed within 1.5 hours and is a promising identification tool for the guava root-knot nematode in pest quarantine and field surveys."

Being able to quickly identify the guava root-knot nematode is critical because of the aggressive nature of the pest.

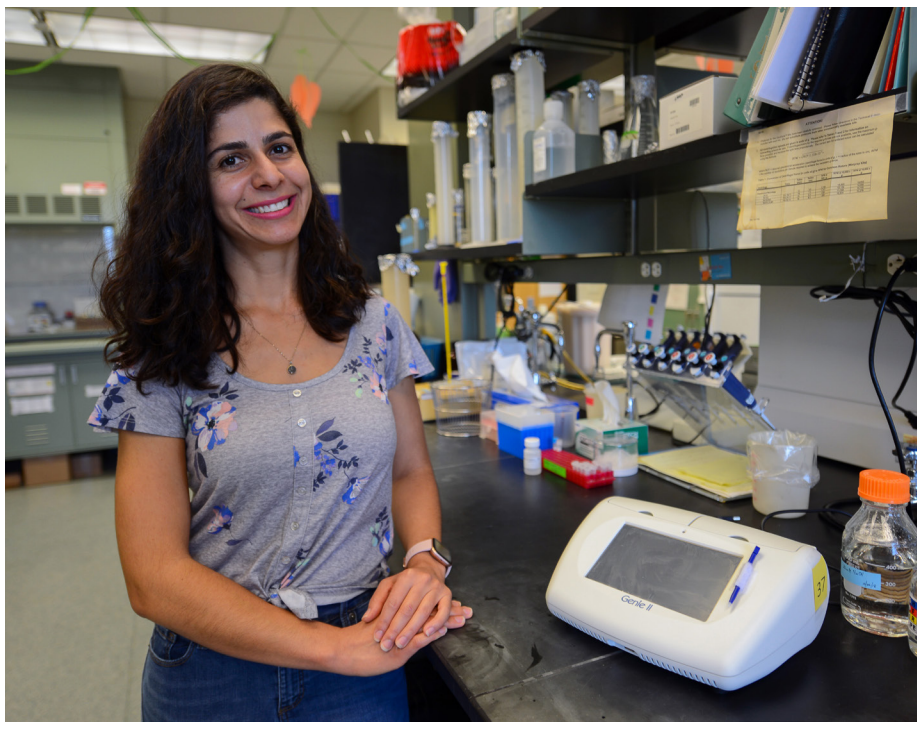
One of the best ways to manage any pest is by planting varieties and hybrids that are not susceptible to that pest. So Rezende also is studying how different soybean varieties and corn and grain sorghum hybrids respond when exposed to the nematode.

"There is limited information about the reaction of most agronomic, vegetable and cover crops in Louisiana to the guava root-knot nematode," Rezende said. "Screening plant varieties of different crops grown in Louisiana could identify potential sources of resistance, thus generating important data that can be applied to manage this nematode in our state."

The nematode did not reproduce or cause galls on any of the corn or sorghum hybrids she tested in 2019. All of the soybean varieties tested, however, developed severe root galling.

Rezende said future research will try to determine if factors such as soybean maturity group affect how susceptible a variety is to the nematode.

"These data can help identify varieties that are very poor hosts and can help manage this nematode if this species develops into a future problem," she said.
Olivia McClure



LSU AgCenter plant pathologist Josielle Rezende stands next to the Genie II, an instrument she uses to identify species of nematodes through a technique called loop-mediated isothermal amplification. Photo by Olivia McClure/LSU AgCenter

Looking at fungicides, other approaches to disease management

Many fungicides are available to help farmers fight the diseases that attack their crops. Those products can be expensive, however, and they do not always have the desired effect.

To help farmers choose the right fungicides for their needs, LSU AgCenter plant pathologist Boyd Padgett is studying the effectiveness of a wide range of commercially available and experimental products.

He also is looking into other approaches to disease management.

Padgett is evaluating hybrids and varieties of corn, grain sorghum, wheat and oats for disease resistance — seeing which are susceptible to diseases that are common in Louisiana and which ones are resistant to those pathogens.

Planting disease-resistant hybrids and varieties can prevent farmers from having to treat their fields with fungicides, saving them money. It's also important in situations where no ideal options are on the market, which is the case with grain sorghum, Padgett said.

Padgett's trials — which are conducted at the Dean Lee, Central and H. Rouse Caffey Rice research stations as well as on private farms — provide data that he shares with other scientists in the AgCenter and at universities across the country. This collaboration is not limited to fellow plant pathologists. That is because many areas of expertise are needed to identify hybrids and varieties — or breed new ones — that offer disease resistance and other desirable traits, such as high yield potential, all in one package.

"There's a lot of effort that goes into it, and there's a lot of different people involved," Padgett said. "There's agronomists and plant pathologists and breeders. It's a lot of fun. It's a team effort for sure."

In a separate project focusing on soybeans, Padgett is examining whether when a crop is planted affects susceptibility to diseases, especially Cercospora leaf blight. He has planted test plots with different varieties and maturity groups on early, normal and late dates. These fields won't be sprayed with any fungicides.

"We'll just observe and see what diseases occur," Padgett said.

Although rain and other factors can cause planting delays, farmers try to avoid putting soybeans in the ground too late so the crop isn't still trying to grow when summer heat sets in. Optimum planting dates in Louisiana vary by location but typically fall between mid-April and mid-May.

"Once you get into June, you start losing yield," he said.

The related choice of maturity group also may have an impact on disease issues. Varieties in maturity groups that mature rapidly aren't in the field as long, leaving less time for diseases to develop. There is more opportunity for diseases to attack varieties that take longer to mature, but they have other advantages that lead farmers to select them.

Some new fungicides are showing promise as effective treatments for Cercospora.

"Prior to that, we didn't have much. Some of the fungicides we had used aren't effective now because the Cercospora populations developed resistance," Padgett said. "Even if the planting date has only a minor effect, I'll take it. There's no silver bullet right now. But if you take fungicides, resistance and planting date, and combine all three, that could be an improvement."
Olivia McClure

LSU AgCenter plant pathologist Boyd Padgett examines soybeans. Photo by Olivia McClure

Louisiana Soybean & Grain Research & Promotion Board Report

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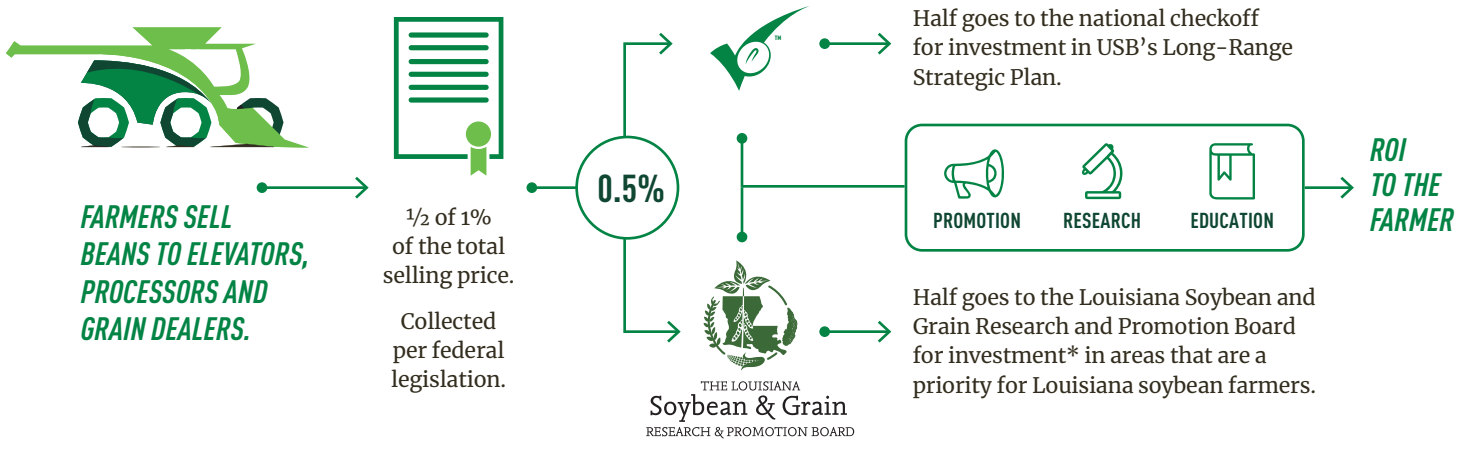
Farmers, LSU researchers, extension agents and others at a ceremony announcing a $1.4 million Patrick F. Taylor Foundation grant awarded to the LSU AgCenter on June 13, 2019 at the AgCenter Botanic Gardens at Burden in Baton Rouge. The grant will fund a project aimed at reducing nutrient runoff from crop fields. Photo by Olivia McClure

HERE'S HOW THE SOY CHECKOFF WORKS

The national soy checkoff was created as part of the 1990 Farm Bill. The federal legislation that created the soy checkoff requires that all soybean farmers pay into the soy checkoff at the first point of purchase. These funds are then used for promotion, research and education at both the state and national level.



CHECKOFF MATH:
RETURNING
$12.34/$1
INVESTED

Source: Cornell University (2019)

For more information on how your soy checkoff dollars are invested, visit unitedsoybean.org.

**Led by 12 volunteer soybean farmers, the Louisiana Soybean and Grain Research and Promotion Board invests and leverages soy checkoff dollars to MAXIMIZE PROFIT OPPORTUNITIES for all Louisiana soybean farmers.*

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